

WHAT IS CLAIMED IS:

1. A method for recycling copper contained in the discarded printed circuit boards, said method comprising the following steps of:

(a) ionizing the copper contained in the discarded printed circuit boards by immersing the discarded printed circuit board in hydrochloric acid (HCl), so as to form a copper chloride ($CuCl_2$) solution;

(b) adding sodium carbonate (Na_2CO_3) into the copper chloride solution, thereby resulting in formation of copper carbonate ($CuCO_3$) and sodium chloride ($NaCl$); and

(c) converting the copper carbonate by heating into copper oxide (CuO).

2. A method, as recited in claim 1, wherein said hydrochloric acid may use an electroplating waste fluid, etching waste fluid, or copper chloride waste fluid, which is a waste product of the manufacturing process of PCB.

3. A method for recycling copper contained in the discarded printed circuit boards, said method comprising the following steps of:

(a) ionizing the copper contained in the discarded printed circuit boards by immersing the discarded printed circuit boards in hydrochloric acid (HCl), so as to form a copper chloride ($CuCl_2$) solution;

(b) adding sodium hydroxide ($NaOH$) into the copper chloride solution, thereby resulting in formation of copper hydroxide, $Cu(OH)_2$, and sodium chloride, $NaCl$; and

(c) converting the copper hydroxide by heating into copper oxide (CuO).

4. A method, as recited in claim 3, wherein said hydrochloric acid may use an electroplating waste fluid, etching waste fluid, or copper chloride waste fluid, which is a waste product of the manufacturing process of PCB.

5. A method for recycling copper contained in the discarded printed circuit boards, said method comprising the following steps of:

(a) ionizing the copper contained in the discarded printed circuit boards

by immersing the discarded printed circuit boards in sulphuric acid (H_2SO_4), so as to form a copper sulphate ($CuSO_4$) solution;

(b) adding sodium carbonate (Na_2CO_3) into the copper sulphate solution, thereby resulting in formation of copper carbonate ($CuCO_3$) and sodium sulphate (Na_2SO_4); and

(c) converting the copper carbonate by heating into copper oxide (CuO).

6. A method, as recited in claim 5, wherein said sulphuric acid may use an electroplating waste fluid, etching waste fluid, or copper chloride waste fluid, which is a waste product of the manufacturing process of PCB.

7. A method for recycling copper contained in the discarded printed circuit boards, said method comprising the following steps of:

(a) ionizing the copper contained in the discarded printed circuit boards by immersing the discarded printed circuit boards in sulphuric acid (H_2SO_4), so as to form a copper sulphate ($CuSO_4$) solution;

(b) adding sodium hydroxide ($NaOH$) into the copper sulphate solution, thereby resulting in formation of copper hydroxide, $Cu(OH)_2$, and sodium sulphate, Na_2SO_4 ; and

(c) converting the copper hydroxide by heating into copper oxide (CuO).

8. A method, as recited in claim 7, wherein said sulphuric acid may use an electroplating waste fluid, etching waste fluid, or copper chloride waste fluid, which is a waste product of the manufacturing process of PCB.

9. A method for recycling copper contained in the discarded printed circuit boards, said method comprising the following steps of:

(a) immersing the discarded printed circuit boards in an oxalic acid ($HOOCCOOH \cdot 2H_2O$) solution, thereby resulting in formation of copper oxalate ($CuC_2O_4 \cdot 1/2H_2O$); and

(b) converting the copper oxalate by heating in presence of oxygen into copper oxide (CuO).

10. A method for recycling copper contained in the discarded printed

circuit boards, said method comprising the following steps of:

(a) ionizing the copper contained in the discarded printed circuit boards by immersing the discarded printed circuit boards in hydrochloric acid (HCl), so as to form a copper chloride ($CuCl_2$) solution; and

(b) adding an aluminium material into the copper chloride solution, thereby resulting in formation of copper powder and an aqueous solution of poly aluminium chloride $[Al_2(OH)_nCl_{6-n} \cdot XH_2O]m$.

11. A method for recycling copper contained in the discarded printed circuit boards, said method comprising the following steps of:

(a) ionizing the copper contained in the discarded printed circuit boards by immersing the discarded printed circuit boards in sulphuric acid (H_2SO_4), so as to form a copper sulphate ($CuSO_4$) solution; and

(b) adding an aluminium material into the copper sulphate solution, thereby resulting in formation of copper powder, and an aluminium sulphate aqueous solution, $Al_2[SO_4]_3$.

12. A device used to recycle copper contained in the discarded printed circuit boards, said device comprising:

a reaction tank having an acid exit in the wall;

a precipitation bath having an acid inlet in the wall, an outlet, and a discharge port of sodium salt, wherein the acid inlet is connected with the acid exit of the reaction tank by a connection pipe which is provided with a valve. And said precipitation bath is provided with an electric agitator;

a conversion oven having a feeding port which is located at the top of the conversion oven and a discharging port which is located at the bottom of the conversion oven; and

a heater, which is disposed in the interior of the conversion oven and provided the temperature of the interior of the conversion oven to kept between 230°C and 350°C.

13. A device, as recited in claim 12, wherein said conversion oven

further comprises a feeding controller, a see-through window, an isolation tank, and a dust remover, wherein said feeding controller is disposed under the feeding port for controlling the feeding speed. Said see-through window is located in the wall of the conversion oven to facilitate the visual observation of the process in progress. Said isolation tank is disposed on the discharging port for preventing copper oxide (CuO) from being contaminated in the course of transfer of the copper oxide. Said dust remover comprises a dust collecting tube, a water bath, and a venture tube dust cleaner. Said dust collecting tube is connected to the wall of the conversion oven. Said venture tube dust cleaner is mounted on the tube wall of the dust collecting tube. A water pipe is connected with the venture tube dust cleaner and the water bath. The water pipe is provided with a pump.

14. A device, as recited in claim 12, wherein said heater is located at the bottom of the conversion oven.

15 A device used to recycle copper contained in the discarded printed circuit boards, said device comprising:

a reactor;

a acid reservoir, which is connected with the reactor by a pipe which is provided with a valve, and said acid reservoir is provided in the wall with a solution transporting pipe which is in turn provided with a pump;

a PAC reaction precipitation bath having a basket for holding aluminium, which is located at the top of PAC reaction precipitation bath and a copper powder exit. The precipitation bath is further provided in the wall with a reaction circulation pipe, which is provided with a reaction circulation pump and a reaction circulation valve. The reaction circulation pipe has one end which is located at the top of the basket. A PAC drain pipe is disposed on the reaction circulation pipe located between the reaction circulation pump and the reaction circulation valve. The PAC drain pipe is provided with a PAC output valve. The pipe of said solution transporting pipe has one end which is extended into the PAC reaction precipitation bath; and

a water tower, which is provided in the wall with a water pipe which is provided with a reaction water admission valve and has one end being extended into the PAC reaction precipitation bath.

16. A device, as recited in claim 15, further comprises a PAC washing and storing apparatus having a washing and filtering tank and a PAC storage tank. Wherein the washing and filtering tank is provided at the top with a filter and is provided in the wall with a PAC output pipe which is provided with a pump. The top of the washing and filtering tank is connected with a PAC filtration pipe, a PAC storage pipe and a return pipe. The PAC filtration pipe, the PAC storage pipe, and the return pipe are all connected with the PAC output pipe and are provided with a valve. The filter and the water tower are connected by a washing pipe which is provided with a valve.